

Before the
Federal Communications Commission
Washington, D.C. 20554

FCC MAIL ROOM

In the Matter of

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The Establishment of Policies and
Service Rules for the Non-Geostationary
Satellite Orbit, Fixed Satellite Service in the
Ku-Band

IB Docket No. 01-96 RECEIVED

NOTICE OF PROPOSED RULEMAKING

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Comment Date: June 18, 2001

Reply Comment Date: July 19, 2001

By the Commission:

I. INTRODUCTION

1. With this Notice of Proposed Rulemaking, we initiate a proceeding to determine the means by which multiple satellite network licensees will share the spectrum we recently designated for the non-geostationary satellite orbit, fixed-satellite service (NGSO FSS), and to determine the intra-service rules that will apply to this new service. Our goals in opening this new satellite service are those we have pursued in commencing other new satellite services: to promote competition through opportunities for new entrants, to expedite the authorization process, and to provide incentives for prompt commencement of service to the public using state-of-the-art technology. A number of pending NGSO FSS applications propose to provide -- through a variety of system designs -- services such as high-speed Internet and on-line access, as well as other high-speed data, video and telephony services. We propose to license all applications on file in this service.

2. Implementation of these new NGSO FSS systems will allow the introduction of an additional means to provide advanced broadband services to the public by satellite, increasing competition to existing satellite and terrestrial services. We also seek to promote competition among the applicants for this new NGSO FSS. Although we recently allocated a significant amount of radio frequency spectrum to the NGSO FSS, the proposals in the pending applications vary widely in their requests for specific frequencies and quantity of spectrum. Consequently, there is no certainty that all these proposals can operate compatibly as proposed in the allocated spectrum. This proceeding will therefore determine where the applicants will operate within the allocated spectrum, by examining and eventually selecting among a number of spectrum sharing options.

3. Our strong preference is to have an outcome dictated by the service market rather than by regulatory decision. We seek comment on the best means to accommodate all of the proposed applicants

within the available spectrum. The spectrum allocated to NGSO FSS is limited, and portions of the allocated spectrum are not interchangeable, in that each spectrum segment has significantly different allocation and sharing constraints. Our eventual choice among spectrum sharing options will be perhaps the most significant decision for the commencement of this service. We propose four possible options for spectrum sharing as a starting point for comment. These proposed options are based upon features of the pending applications, upon other proposals received from the applicants, and upon sharing mechanisms we have previously employed with other satellite services.

4. We also request comment on service rules we propose herein for the NGSO FSS licensees. We start with our existing satellite service rules,¹ hoping that by building upon them, we can avoid the addition of duplicative and unnecessary rules.

II. BACKGROUND

5. In July 1997, SkyBridge L.L.C. (SkyBridge) filed a Petition for Rulemaking (SkyBridge Petition) requesting that the Commission amend Parts 2 and 25 of its rules to permit NGSO FSS systems to operate in the United States in the 10.7-12.7 GHz band for NGSO space-to-earth links (downlinks) (a total of 2 gigahertz) and in the 12.75-13.25 GHz, 13.75-14.5 GHz, and 17.3-17.8 GHz bands for NGSO earth-to-space links (uplinks) (a total of 1.75 gigahertz).² The downlink bands that SkyBridge requested are generally used by geostationary satellite orbit fixed satellite service (GSO FSS), broadcast satellite service (BSS) and terrestrial fixed services. The requested uplink bands are used by GSO FSS operations, fixed services, mobile services, and Government space and terrestrial operations. SkyBridge also proposed technical criteria to protect GSO FSS, GSO BSS, and some terrestrial operations in these bands from interference from NGSO FSS systems. SkyBridge stated that its proposal would provide advanced satellite services to the public and increase competition within the broadband market without having to dedicate additional spectrum resources to this end.³ By using NGSO satellites that operate in the Ku-band with lower earth orbits, SkyBridge expected that its system's propagation times between transmitter and receiver would be similar to those for landline broadband transmission systems, and that the costs for some key items, such as user terminals, would be similar to those for GSO FSS systems.

6. In response to the SkyBridge Petition and technical standards provisionally adopted by the World Radio Conference,⁴ in November 1998 the Commission released a Notice of Proposed Rulemaking to permit NGSO FSS operations in certain segments of the Ku-band.⁵ In that *Ku-Band*

¹ 47 C.F.R. §§ 25.101 to 25.281.

² SkyBridge Petition, RM-9147, filed July 3, 1997.

³ See SkyBridge Petition at 3.

⁴ The 1997 World Radio Conference (WRC-97) adopted provisional power limits for certain segments of the Ku and Ka frequency bands to promote spectrum sharing between NGSO FSS systems and other systems and services. Because the technical studies justifying these power limits had not been fully considered in the International Telecommunication Union Radiocommunication Sector (ITU-R) study group process, as is customary, they were deemed provisional until they could be analyzed by the relevant ITU-R study groups and reviewed at the 2000 World Radio Conference (WRC-2000).

⁵ *Notice of Proposed Rule Making*, ET Docket No. 98-206, 14 FCC Rcd 1131 (1998) (*Ku-Band Sharing NPRM*). The Ku-band typically refers to frequencies in the vicinity of 10-14 GHz. The specific bands subject to this proceeding are the 10.7-12.7 GHz, 12.75-13.25 GHz and 13.75-14.5 GHz bands. For the purposes of this proceeding, we use the term "Ku-band" to refer generally to all of the frequency bands listed above that are under consideration in this proceeding. The Ka-band typically refers to the 17.7-20.2 GHz (downlink) and 27.5-30.0 GHz (uplink) bands.

Sharing NPRM, we proposed to allow NGSO FSS operations to use the 10.7-12.7 GHz band for NGSO FSS downlinks on a co-primary basis and to use the 12.75-13.25 GHz and 13.8-14.5 GHz bands for NGSO FSS uplinks on a co-primary basis.⁶ In addition to requesting comment on issues specific to a proposed Ku-band NGSO FSS, the *Ku-Band Sharing NPRM* requested comment on inter-service sharing between the new service and existing GSO FSS and terrestrial fixed and mobile services already incumbent in the Ku-Band frequencies under discussion. Finally, the *Ku-Band Sharing NPRM* also asked for comments on a Petition for Rulemaking filed by Northpoint Technology, Ltd. (Northpoint), which proposed to provide terrestrial retransmission of local television signals and data services on a secondary basis⁷ to the incumbent broadcast satellite service in the 12.2-12.7 GHz band.⁸ That band is among those in which the *Ku-Band Sharing NPRM* proposed to authorize NGSO FSS operations.

7. The United States -- with representation from the terrestrial fixed service, NGSO FSS and GSO FSS industries -- was an active participant in the ITU-R technical study groups that conducted analyses of these sharing issues in preparation for WRC-2000. These ITU-R working groups made significant progress on NGSO FSS sharing issues. The WRC-2000 Conference Preparatory Meeting (CPM) was held in November 1999. The final CPM report contains information on technical, operational and regulatory or procedural issues relevant to items on the WRC-2000 agenda. This report included input from various ITU-R working parties and study groups, individual Administrations, and international organizations regarding NGSO FSS sharing issues, and formed the technical basis for decisions on these issues. WRC-2000 affirmed the outcomes in the CPM report that are relevant to this proceeding.⁹ As we noted in the *Ku-Band Sharing NPRM*, ITU-R deliberations are based on the technical input of many Administrations that often have different domestic spectrum uses than those in the United States.¹⁰ While the conclusions of the ITU-R study groups, the CPM, and WRC-2000 may have general technical applicability, they may not adequately address specific domestic sharing conditions prevalent here in the United States. Consequently, in the *Ku-Band Sharing* proceeding, we sought comment on a variety of techniques that could be used to facilitate co-primary operation of NGSO FSS and incumbent services in the United States, where the Ku-band is already used extensively.

⁶ Except for the 12.2-12.7 GHz band, all of the bands allocated for NGSO FSS use are already allocated to the FSS on a primary or co-primary basis. The *NPRM* also proposed, and our subsequent order adopted, a co-primary allocation for NGSO FSS in the 12.2-12.7 GHz band. A given frequency band may be allocated to one or more terrestrial or space radiocommunication services or the radio astronomy service on either a primary or secondary basis. See Final Acts of the 1992 World Radio Conference, Malaga-Torremolinos (1992). A service designated as primary in a particular band enjoys priority status for operations in that band. A service designated as co-primary shares the band with other services given co-primary status on an equal basis. See 47 C.F.R. § 2.105(c).

⁷ A service designated as secondary may operate in a particular band only to the extent that it does not cause harmful interference to any primary or co-primary designated service. See 47 C.F.R. § 2.105(c)(3). See also International Telecommunication Union Radio Regulations, Edition of 1998, Article S5, Section II -- Categories of services and allocations, S5.28 through S5.31 ("Stations of a secondary service: a) shall not cause harmful interference to stations of primary services to which frequencies are already assigned or to which frequencies may be assigned at a later date; b) cannot claim protection from harmful interference from stations of a primary service to which frequencies are already assigned or may be assigned at a later date; c) can claim protection, however, from harmful interference from stations of the same or other secondary service(s) to which frequencies may be assigned at a later date").

⁸ Northpoint Petition, RM-9245, filed March 6, 1998.

⁹ WRC-2000 was held in Istanbul, Turkey, from May 8 to June 2, 2000.

¹⁰ *Ku-Band Sharing NPRM* at ¶ 11.

8. After considering the comments filed in response to the *Ku-Band Sharing NPRM*, we adopted our *First Report and Order and Further Notice of Proposed Rulemaking* in November 2000.¹¹ In that *First Report and Order*, we permitted NGSO FSS providers to operate in certain segments of the Ku-band, and adopted rules and policies to govern such operations. We also adopted technical criteria so that NGSO FSS operations can share spectrum with incumbent services without causing unacceptable interference to them and without unduly constraining future growth of incumbent services or NGSO FSS system flexibility. Finally, we concluded that a new terrestrial fixed Multichannel Video Distribution and Data Service (MVDDS) can operate in the 12.2-12.7 GHz band on a non-harmful interference basis with incumbent BSS, and on a co-primary basis with the NGSO FSS.¹² By these actions, we provided for the introduction of new advanced services to the public, consistent with our goal of encouraging their deployment,¹³ and promoted increased competition among satellite and terrestrial services.

9. In addition to its Petition, SkyBridge filed an application for authority to launch and operate an NGSO FSS system.¹⁴ In November 1998, the Commission issued a Public Notice that established a cut-off date for filing NGSO FSS system applications in portions of the Ku-band.¹⁵ There are seven applications pending for different NGSO FSS systems, requesting access to all or some portion of the bands allocated to this service. A brief description of each system is provided in Appendix D. The applicants propose a variety of orbit constellations and network designs and a wide range of services, including high-speed Internet and on-line access, video conferencing, telephony, and entertainment services. These proposals offer an opportunity for competition to both satellite and terrestrial services. Certain characteristics of the proposed SkyBridge network, such as gateway earth stations, were discussed in the *Ku-Band Sharing NPRM* to facilitate the development of a complete record. While this proceeding focuses on spectrum sharing among multiple NGSO FSS systems and discusses certain characteristics of proposed systems as appropriate, licensing of the individual applicants will be discussed in separate orders addressing their respective applications.

¹¹ *First Report and Order and Further Notice of Proposed Rulemaking*, ET Docket No. 98-206, FCC 00-418, 2000 WL 1804138 (released December 8, 2000) (*First Report and Order*).

¹² In the *Further Notice of Proposed Rulemaking* portion of the *First Report and Order*, we request comment on specific technical rules to allow co-frequency use by the MVDDS and NGSO FSS systems. FCC 00-418, ¶¶ 277-281. The *Further Notice of Proposed Rulemaking* also addresses MVDDS and incumbent DBS sharing in the 12.2-12.7 GHz band. FCC 00-418, ¶¶ 266-276. All NGSO FSS systems addressed in this proceeding will also be subject to the rules developed in that proceeding for MVDDS and NGSO FSS sharing.

¹³ Section 706 of the 1996 Telecommunications Act 47 U.S.C. § 157.

¹⁴ File No. 48-SAT-P/LA-97 (SkyBridge Application). The SkyBridge Application has been amended several times: File No. 89-SAT-AMEND-97; File No. 130-SAT-AMEND-98; File No. SAT-AMEND-19980630-00056; File No. SAT-AMEND-19990108-00004. The SkyBridge Application initially proposed 64 NGSO satellites for its system, but as subsequently amended SkyBridge now proposes 80 NGSO satellites.

¹⁵ Report No. SPB-141, released November 2, 1998 (*Ku Band Cut-Off Notice*). The filing cut-off was for NGSO FSS applications in the 10.7-12.7, 12.75-13.25, 13.75-14.5, and 17.3-17.8 GHz frequency bands. In that Public Notice, we advised that "applicants should be aware that because of outstanding Commission proceedings and Government use of certain frequency bands, not all bands proposed by the applicants in this Public Notice will necessarily be available for NGSO FSS use." In the *First Report and Order*, we decided not to allocate the 17.3-17.8 GHz band to NGSO FSS. FCC 00-418, ¶¶ 152-158.

III. SPECTRUM ALLOCATED TO NON-GEOSTATIONARY SATELLITE ORBIT FIXED SATELLITE SERVICE

10. As briefly described above, the *First Report and Order* allocated to the NGSO FSS in the United States most of the spectrum allocated to the NGSO FSS internationally by the ITU. Our domestic allocation was less than the international allocation, however, because we are constrained by the need to protect substantial incumbent operations and licensees in the Ku-band frequencies.

11. In the *First Report and Order*, we permitted NGSO FSS gateway¹⁶ earth stations to provide, on a primary basis, space-to-Earth transmissions (downlinks) in the 10.7-11.7 GHz band¹⁷ and Earth-to-space transmissions (uplinks) in the 12.75-13.15 GHz, 13.2125-13.25 GHz, and 13.75-14.0 GHz bands,¹⁸ thereby providing 1000 megahertz of spectrum for gateway downlink and 687.5 megahertz of spectrum for gateway uplink operations. Further, we permitted gateway earth stations to operate in the 11.7-12.7 GHz downlink¹⁹ and 14.0-14.5 GHz uplink²⁰ bands that will be predominantly used by NGSO FSS service links.

12. We permitted NGSO FSS to operate service downlinks in the 11.7-12.2 GHz band²¹ on a primary basis, and we permitted NGSO FSS service downlinks to operate in the 12.2-12.7 GHz band²² on a co-primary basis. We also permitted NGSO FSS to operate service uplinks in the 14.0-14.5 GHz band.²³ This provides 1000 megahertz of spectrum for service downlink and 500 megahertz of spectrum for service uplink operations.

13. Aside from grouping the allocated spectrum by function, as described above, the respective allocations for NGSO FSS gateway operations and NGSO FSS operations may also be represented by grouping together all NGSO FSS transmissions from space to the Earth (downlinks) and then, in turn, grouping together all NGSO FSS transmissions from the Earth-to-space (uplinks). Two charts reprinted in Appendix A summarize the NGSO FSS downlink and uplink bands, respectively, and incumbent operations in them.

14. These spectrum allocations to the NGSO FSS are also limited by a number of technical specifications that we developed in the prior proceeding. In the *First Report and Order*, we adopted technical sharing criteria (power flux-density (PFD) limits) for NGSO FSS and FS operations in the

¹⁶ The term "NGSO FSS gateway earth station" was defined in the *First Report and Order* as an earth station complex consisting of multiple interconnecting earth station antennas supporting the communication routing and switching functions of a non-geostationary satellite orbit fixed-satellite service (NGSO FSS) system as a whole. See *First Report and Order*, FCC 00-418, at ¶¶ 23-31 and Appendix B. The full definition was added to the Commission's Satellite Communications Rules, 47 C.F.R. § 25.201.

¹⁷ *First Report and Order*, FCC 00-418, ¶¶ 32-119

¹⁸ *Id.* at ¶¶ 120-147.

¹⁹ *Id.* at ¶ 161.

²⁰ *Id.* at ¶¶ 135-151.

²¹ *Id.* at ¶¶ 159-161.

²² *Id.* at ¶¶ 162-228.

²³ *Id.* at ¶¶ 229-231.

10.7-11.7 GHz band, consistent with decisions taken at WRC-2000.²⁴ Although we tentatively concluded that we should identify geographic protection zones for incumbent FS operations in the 10.7-11.7 GHz and 12.75-13.25 GHz bands, we deferred until a separate future proceeding a decision on what procedures to use for determining the size and location of such zones.²⁵ We also deferred until a separate future proceeding a decision on coordination procedures between NGSO FSS and FS authorized under Parts 74 and 78 in the 12.75-13.25 GHz band.²⁶ Finally, we adopted technical sharing criteria (equivalent power flux density (EPFD) uplink and downlink limits)²⁷ for NGSO FSS systems to protect geostationary-satellite orbit (GSO) FSS and BSS operations in all bands, consistent with decisions taken at WRC-2000.²⁸ In the *Further Notice of Proposed Rulemaking* portion of that document, we requested comment on how the new MVDDS systems and new NGSO FSS systems can operate with each other and with incumbent DBS operations in the 12.2-12.7 GHz band.²⁹

IV. DISCUSSION

15. Bearing in mind the allocated spectrum and all the attendant technical criteria determined by the *First Report and Order*, we must now decide upon a means to determine what portions of the allocated spectrum will be authorized for use by the respective NGSO FSS licensees. In this Notice of Proposed Rulemaking (*Notice*), we first discuss a number of possible spectrum sharing options among the NGSO systems, seeking comment on which option -- or variation on a proposed option -- can best accommodate the new service. We also discuss several remaining intra-service technical issues, seeking comment on how to establish intra-service sharing criteria to address them. We then review a number of service rules issues, some of which were addressed, at least in part, in the *Ku-Band Sharing NPRM*. We ask for further comment on those service rules issues, in light of the decisions made in the *First Report and Order*, and considering any issues raised by the NGSO FSS spectrum sharing options set forth in this *Notice*.

A. Spectrum Sharing Options

16. The issues before us are unique and highly complex. We recognize that there is not enough allocated Ku-band spectrum to accommodate -- without potential interference -- all proposed NGSO FSS systems if each system were to use the full amount of spectrum it has requested. We also recognize that all seven NGSO FSS proposals vary in their complexity, purpose, requirements, and systems designs. Nevertheless, we tentatively conclude, for purposes of comment and discussion, that there is sufficient

²⁴ *First Report and Order*, FCC 00-418, at ¶¶ 34-42.

²⁵ *Id.* at ¶¶ 57-67.

²⁶ *Id.* at ¶¶ 127-128.

²⁷ PFD is a measure of the amount of energy emitted by a transmitter that is present over a unit area at the Earth's surface or at the satellite, and is a critical factor in determining whether satellite systems can successfully share spectrum with other services or satellite systems. EPFD limits are intended to control the level of signal energy on the earth's surface. Each EPFD limit applies to a particular GSO earth station receiver with a specific antenna diameter and sidelobe pattern. Consequently, different sized GSO FSS earth station receivers may require different EPFD protection requirements. Aggregate equivalent power flux-density (APFD), also a concern in this service, is the sum of the PFD levels at a location on the GSO arc created by all potentially interfering earth station transmitters of a NGSO FSS system.

²⁸ *First Report and Order*, FCC 00-418, at ¶¶ 72-108.

²⁹ *First Report and Order and Further Notice of Proposed Rulemaking*, FCC 00-418, at ¶¶ 266-281.

spectrum in the Ku-band NGSO FSS allocation to accommodate all seven proposals. To that end, we seek comment on four distinct spectrum assignment options: (1) Flexible Band Segmentation; (2) Dynamic Band Segmentation; (3) Avoidance of In-line Interference Events; and (4) Homogeneous Constellations. By proposing these options, we seek to establish a regulatory framework that does not favor any particular technology or operational method. It is our firm belief that the marketplace should decide the most effective implementation of the NGSO FSS systems. Hence, our proposed spectrum assignment options are premised on the following three principal objectives.

17. First, we seek to ensure that all applicants have equal access to spectrum. Given the inherent non-fungibility of frequencies within the NGSO FSS spectrum allocation, the proposed options are structured to mitigate the effects of varying regulatory and sharing constraints that are associated with that allocation.³⁰ The inter-service sharing arrangements decided in the *First Report and Order* restrict certain types of NGSO FSS system operations to designated portions of the NGSO FSS spectrum. In order for all NGSO FSS licensees to accomplish that function, therefore, all licensees must have a portion of the NGSO FSS spectrum to which those operations are restricted. We identify three distinct sub-bands in the NGSO FSS uplink spectrum allocation -- 12.75-13.25 GHz,³¹ 13.75-14.0 GHz and 14.0-14.5 GHz -- and three distinct sub-bands in the downlink allocation -- 10.7-11.7 GHz, 11.7-12.2 GHz and 12.2-12.7 GHz (six sub-bands altogether).³² We believe that at a minimum, all NGSO FSS systems need to have access to some spectrum in each of these sub-bands. We recognize that even within each of these six sub-bands, spectrum accessibility and associated sharing constraints are not uniform. On the other hand, we appreciate the technical challenges and spectrum inefficiencies that are associated with spectrum fragmentation. We therefore ask for comment on the identified NGSO FSS spectrum sub-bands and whether the issue of spectrum non-fungibility is adequately addressed by our proposals.

18. Second, although we hope that all authorized systems will be built, our experience with the implementation of NGSO systems cautions us to recognize that it is possible, if not likely, that not all proposed systems will be implemented. We therefore seek to prevent spectrum warehousing by non-implemented NGSO FSS systems at the expense of operational systems. All four options we propose in this *Notice* attempt to maximize spectrum availability to operational systems, while incorporating sufficient flexibility to accommodate all applicants once they commence operations. We seek comment on the disposition of spectrum capacity that is unused when systems are not timely implemented. We also seek comment on whether the systems' designs are sufficiently flexible to make interim use of additional spectrum in the period before additional systems are implemented, and the effect that interim use may have on the operations of all other systems.

19. Third, recognizing the limited availability of NGSO FSS spectrum to accommodate these broadband operations, we are convinced that the public interest would be well served to the extent that the systems' proponents are able to share cooperatively their respective spectrum assignments. Thus, the options presented here are structured to provide regulatory certainty to the NGSO FSS licensees but not to preclude, in any way, the NGSO FSS systems' coordinated use of their spectrum assignments. Given

³⁰ See *First Report and Order*, FCC 00-418, at ¶ 2.

³¹ The NGSO FSS allocation excludes frequencies in the 13.15-13.2125 GHz band. See *First Report and Order*, FCC 00-418, at ¶ 122.

³² The 10.7-11.7 GHz, 12.75-13.25 GHz, 13.75-14.0 GHz sub-bands are shared with GSO FSS and terrestrial services and, thus, are restricted only to NGSO FSS gateway operations. 14.0-14.5 GHz is the only band that can be used by NGSO FSS service uplinks. NGSO FSS service downlinks can be implemented in the 11.7-12.2 GHz and 12.2-12.7 GHz bands, but the 11.7-12.2 GHz band is shared with GSO FSS and the 12.2-12.7 GHz band is shared with GSO BSS and MVDSS.

the obvious benefits of coordinated spectrum sharing, we believe that the NGSO FSS operators will attempt to negotiate such arrangements with each other. We ask commenters to address whether the proposed options incorporate sufficient flexibility to promote and accommodate spectrum coordination by the systems' proponents.

20. To the extent that commenters assert that any of our proposed options do not provide sufficient spectrum capacity for a particular system, they must specify the minimum spectrum required to support such a system, and substantiate this assertion with concrete technical and economic analyses. To the extent that comments regarding any option address whether that option provides adequate business certainty to support an economically viable license, commenters must show how the option might be modified to enhance success in the competitive marketplace.

21. While we are prepared to move forward expeditiously with any of these spectrum assignment proposals, we reserve the option of adopting an alternative engineering solution or band sharing arrangement that might include a hybrid solution arising from the options described below, or an alternative solution negotiated by the applicants. Interested parties will have an opportunity to comment on alternative proposals that are markedly different from those set forth in this *Notice*.

22. Finally, although the primary objective of this proceeding is to establish applicable intra-service rules that would allow multiple NGSO FSS satellite networks to share spectrum, we acknowledge that inter-service sharing is an important consideration when we assign spectrum within this service. We also recognize that the ability to share spectrum on a co-primary basis with other services is dependent on system design and, therefore, is specific to each NGSO FSS proposal. We therefore seek comment on whether there is a need to adjust the four proposed spectrum assignment options to facilitate inter-service sharing.

1. Option I – Flexible Band Segmentation

23. One option for sharing the NGSO FSS Ku-band spectrum is Flexible Band Segmentation. This option would segment the available spectrum at the time of licensing to accommodate all NGSO FSS proposals and provide flexibility for system implementation and expansion. Under this option, each of the six sub-bands would be divided into distinct spectrum segments of equal bandwidth (Selected Spectrum Assignments) based on the number of system proponents at the time that we authorize the NGSO FSS systems. The segments will consist of adjacent blocks stretching from one end of the sub-band to the other.³³ Each NGSO FSS licensee will identify one selected spectrum segment in each sub-band at the time that the first satellite in its system reaches its intended orbit and initiates transmission and reception, and will be required to notify the Commission, in writing, of its identified segments.³⁴ An assortment of six segments (one in each sub-band) will represent the operator's Selected Spectrum Assignment. The Commission staff will then issue a Public Notice to provide notification of the licensee's selected segments.

24. Under this option, in addition to operating in its own Selected Spectrum Assignment, each licensee may provide service anywhere else within unoccupied spectrum allocated to the NGSO FSS.³⁵

³³ For instance, if there are seven applicants, we would identify seven equal spectrum segments within the 12.75-13.25 GHz, 13.75-14.0 GHz, 14.0-14.5 GHz, 10.7-11.7 GHz, 11.7-12.2 GHz and 12.2-12.7 GHz sub-bands.

³⁴ A satellite's intended orbit is the orbit it will occupy to provide commercial service.

³⁵ This additional spectrum is "unoccupied" because it has not yet been identified as selected spectrum by an operational NGSO FSS licensee.

In addition, each licensee may coordinate with any other NGSO FSS licensee also using spectrum outside of its Selected Spectrum Assignment. When using spectrum other than a Selected Spectrum Assignment, no licensee will have priority over another. If licensees cannot coordinate use in a desired additional portion of spectrum, those frequencies cannot be used. In other words, a licensee can claim priority use only in its own Selected Spectrum Assignment in each sub-band. Operations outside a licensee's Selected Spectrum Assignment are subject to appropriate coordination with other operational NGSO FSS systems.

25. We expect the NGSO FSS licensees to have spectrum requirements that initially will be modest, but will increase following commencement of commercial operations. Flexible Band Segmentation would create sufficient certainty to proceed with system implementation. We recognize that under this option the amount of spectrum available to each system will decrease as more NGSO FSS operators proceed with system implementation. If we adopt a sharing option in which specific spectrum segments are assigned to particular systems, we cannot assume that the same bands will be assigned to the same systems in other countries. Commenters should therefore also address the possible effects of Flexible Band Segmentation on U.S.-licensed systems' operations outside the United States. We seek comment on all aspects of Flexible Band Segmentation, including variations or alternatives that commenters propose.

2. Option II – Dynamic Band Segmentation

26. Dynamic Band Segmentation is similar to Flexible Band Segmentation. Under this approach, we propose to subdivide each NGSO FSS spectrum sub-band equally by the number of operational systems. Each time a new system becomes operational, other operational systems would be required to surrender spectrum to accommodate the new entrant. The system would be considered operational at the time that the first satellite in its system reaches its intended orbit and initiates transmission and reception. Recognizing the public interest benefit of hastening the provision of NGSO FSS to the public, we propose that priority in selecting spectrum segments should be based on the date a licensed system becomes operational. Under this option the first operational system would have access to all available spectrum. When there are two operational systems, then each of the six spectrum sub-bands would be split in two equal parts, with the first system to become operational having the right to select its spectrum segments. When there are three systems, then the spectrum would be split into three equal parts, and again the first system would select its spectrum segments, followed by the second system and the remaining spectrum segments would go to the third system, and so on. Nothing would prevent systems that find ways to share from pooling their spectrum segments. The process would be implemented by the applicants upon implementation of each new system. Every system will notify the Commission of its specific frequency assignments.

27. We seek comment on Dynamic Band Segmentation, and whether it is preferable to a more structured band sharing arrangement. We seek comment on how Dynamic Band Segmentation might give system proponents the flexibility to initiate service to the public based on business needs and market forces, and to implement or update their systems to include new technologies. We note that service providers will be required to readjust and reduce the spectrum they occupy as additional systems become operational. We seek comment on any impact that such adjustments might have on the system's customers and how that impact might be mitigated. As noted with regard to Flexible Band Segmentation, above, we cannot assume that the same bands that we assign to particular systems will also be assigned in other countries. Commenters should therefore also address the possible effects of Dynamic Band Segmentation on U.S.-licensed systems' operations outside the United States. We seek comment on all aspects of Dynamic Band Segmentation, including variations or alternatives that commenters propose.

3. Option III – Avoidance of In-Line Interference Events

28. One distinctive characteristic of all the proposed NGSO FSS systems is the directivity of the satellite and earth station antennas they must employ.³⁶ Operating on Ku-band frequencies and sharing with GSO networks requires the use of directive antennas for both earth and space station operations within a NGSO FSS network.³⁷ A third spectrum sharing option is based upon avoiding in-line interference events. This option is premised on the necessary directivity of NGSO FSS antennas. In discussing this option, we recognize that separate NGSO satellite systems could share the same spectrum frequency and coverage so long as they avoid near in-line interference events.

29. An in-line interference event occurs whenever there is an unintentional transmission in either direction between an earth station of one system and a satellite of another caused by physical alignment. In the *First Report and Order*, we discussed in-line interference events in a GSO FSS and NGSO FSS sharing context.³⁸ Extrapolating from that definition to the NGSO FSS to NGSO FSS sharing context of this *Notice*, an in-line event is a physical phenomenon in which one NGSO FSS system's in-line transmission path between its satellite and one of its earth stations is intersected by the in-line transmission path of another NGSO FSS system's satellite or its earth station, all of them aligned in a straight line. During an in-line event, a NGSO FSS earth station would receive the highest interference level from the other NGSO FSS system's transmitting satellite when the satellite mainbeam transmission path is aligned with the earth station antenna. Conversely, the other NGSO FSS system's satellite would receive the highest interference level by the in-line transmission path of the earth station's mainbeam transmission.

30. There are essentially two possible techniques for coping with in-line interference events: satellite diversity and frequency isolation.³⁹ With satellite diversity, NGSO FSS systems avoid the in-line interference by selecting another visible satellite within its system constellation whenever the current satellite approaches the in-line event with a satellite operating in another NGSO FSS system constellation. Satellite diversity implies performing a hand-over (switching) process, selecting an alternative satellite in one system in order to avoid interfering with the in-line transmission path between an earth station and space station in another system. Alternatively, the two NGSO FSS licensees could agree to split the spectrum between their two systems, solely for the duration of that potential in-line interference event, thereby avoiding interference through frequency isolation. In either case, operations of both NGSO FSS systems in accordance with the in-line event spectrum sharing procedure will require close cooperation of the involved NGSO FSS operators. At a minimum, it will require periodic exchanges of ephemeris data for each affected NGSO FSS system between the respective authorized system operators.⁴⁰

³⁶ Directivity of an antenna is a performance characteristic defined by a ratio of signal energy received (or transmitted) between desired and unwanted directions. Directivity indicates the antenna's ability to receive (or transmit) signals arriving from desired direction and reject (suppress) signals coming from unwanted directions. Generally, the more highly directive an antenna, the better it can reject signals from the sides and rear.

³⁷ See *First Report and Order*, FCC 00-418 at ¶ 243.

³⁸ *First Report and Order*, FCC 00-418 at ¶ 79 n. 181.

³⁹ See ITU-R S.1431.

⁴⁰ Ephemeris data are technical parameters for a particular satellite that allow one to compute the location of that satellite in its orbit at any given time. In the *First Report and Order* we required NGSO FSS licensees to publish their ephemeris data. Specifically, we required NGSO FSS licensees to publish their (continued....)

31. The potential for in-line interference events -- and therefore the need to employ satellite diversity or frequency isolation to remediate them -- increases with the number of NGSO FSS systems placed into operation. The preceding discussion involved the most likely in-line interference event, involving two satellites from two operating systems, which can be called a two-satellite in-line interference event. In the case of three operating NGSO FSS systems, there are two possible combinations of two satellites aligning with an earth station for an interference event (one of the two being an unintended point of communication), as well as a more remote possibility that three satellites could align their transmission paths with the earth station mainbeam of one of the three systems (with two satellites being unintended points of communication). In the case of four operating NGSO FSS systems, there are three possible combinations leading to a two-satellite in-line interference event and two possible combinations leading to a three-satellite in-line interference event. The complexity of possible in-line interference events therefore rises as a function of the number of operating NGSO FSS systems. We request comment on the likelihood of occurrence of in-line interference events. In particular, we seek comment on whether the complexity of managing multi-constellation in-line interference events through satellite switching protocols or frequency selection algorithms would negate the inherent benefits of this spectrum sharing option. We also recognize that requiring satellite diversity would increase the technical complexity⁴¹ of NGSO FSS systems. We seek comment on the impact this complexity may have on systems' designs and commercial feasibility, and we ask commenters to quantify this impact.

32. Under this option, whenever in-line interference events are not a threat, NGSO FSS systems would share the entire spectrum allocated to NGSO FSS systems, since inter-system interference is minimal. Prior to the launch of its first satellite, each NGSO FSS operator would be required to complete coordination with all other operational NGSO FSS systems.⁴² The coordination may be completed by employing satellite diversity in combination with other available interference mitigation techniques.⁴³ If operators cannot reach a coordination agreement with a new entrant, then they would be required to establish an in-line event spectrum sharing procedure based on the frequency isolation technique, that is, segmenting the spectrum among the operating systems involved in the predicted specific in-line interference event. For the duration of the in-line event the satellite system operators would be required to divide the spectrum equally in each of the six sub-bands. Again, recognizing the public interest benefit of hastening the provision of NGSO FSS to the public, we propose that priority in

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satellites' elements in the North American Aerospace Defense Command (NORAD) 2-line element format. *First Report and Order*, FCC 00-418 at ¶ 102, and Section 25.271(e) of the Commission's rules, adopted therein.

⁴¹ The increased technical complexity takes at least two forms. First, satellite diversity, by its nature, requires the earth station to select another satellite within its constellation in order to provide continuous uninterrupted service. Consequently, for the duration of the in-line interference event, the in-line satellite's capacity cannot be used, and overall system capacity is not fully utilized. This requires, in turn, that NGSO FSS systems build additional capacity to compensate for the capacity lost during the in-line interference events. A second technical complexity is that earth stations must detect the onset of in-line interference events, predict the duration of the event, and determine to which other satellite in its constellation it will switch. These reactions require complex software and switching hardware, in order to provide seamless communications during an in-line interference event.

⁴² A system is deemed operational when at least one of its satellites reaches its intended orbit and initiates transmission and reception of radio signals.

⁴³ See ITU-R S.1431 (e.g., satellite diversity, alternate polarization, etc.).

selecting spectrum segments would be based on the date the first satellite of each system successfully reaches its intended orbit and initiates transmission and reception.

33. Although we have so far described in-line events in lay terms, we would need to establish an unambiguous technical definition of in-line interference event parameters if we were to adopt this option. In this regard, we note that for GSO FSS, it has long been established that a requirement to coordinate, for co-frequency operation, should be based on maximum allowable inter-network interference. For example, coordination is triggered between GSO FSS systems only when the inter-network interference caused by the earth and space station emissions of any one other network operating in the same frequency band or bands is greater than six percent (6%) of the total system noise power under clear-sky conditions.⁴⁴ Under this option, we would apply the same coordination criterion for the definition of an in-line interference event trigger mechanism between NGSO FSS systems. We seek comment on whether or not this coordination threshold properly defines the in-line interference event situation. We ask commenters to assess the feasibility of this definition within the context of avoiding in-line interference events and the NGSO FSS system proposals before us.

34. We recognize that the technical definition of an in-line interference threshold trigger in GSO FSS services is based on clear sky conditions, which are long-term in nature. In-line interference events between NGSO systems are, however, short-term, transient phenomena. The duration of the transient period depends upon the altitude of the NGSO constellations affected, the earth station antenna size, and the number of satellites involved in the in-line interference event. In commenting on the appropriate technical definition of an in-line interference event, we ask commenters to consider the extent to which clear-sky conditions are assumed in their definition of an in-line interference event. In comments it filed in response to the *Ku-Band Sharing NPRM*, SkyBridge estimated that in-line interference events will potentially occur approximately five percent of the time, as between two NGSO constellations of the type proposed in its application.

35. SkyBridge advocates the in-line event avoidance technique as the most appropriate method for implementing sharing among the proposed Ku-band NGSO FSS systems.⁴⁵ SkyBridge proposes that we adopt an earth-based +/- 10 degree angle between the satellites of the constellations as a trigger for the in-line event.⁴⁶ Furthermore, SkyBridge asserts that its earth-angle-based approach is feasible only if it is coupled with a uniform limitation on power levels of the NGSO FSS transmitters. We request comment on the in-line event condition proposed by SkyBridge as well as the associated implementation requirements.

36. The Avoidance of In-Line Interference Events option requires sub-dividing the NGSO FSS spectrum only during the time intervals involved in potential in-line interference events. During all other times, the affected NGSO FSS systems can operate using the entire allocated spectrum. We request comment on all aspects of the Avoidance of In-Line Interference Events option, including variations or alternatives that commenters propose. Commenters should provide support for all assertions and quantify, with supporting documentation, any alleged impact adopting this option would have on their proposed system and its operations.

⁴⁴ See ITU-R, Recommendation S.735-1.

⁴⁵ SkyBridge L.L.C. Notifications of *Ex Parte* Presentations in ET Docket No. 98-206, November 30, 2000 and February 28, 2001.

⁴⁶ SkyBridge L.L.C. Notification of *Ex Parte* Presentation in ET Docket No. 98-206, March 27, 2001.

4. Option IV – Homogeneous Constellations

37. The ITU has determined that several NGSO FSS systems can share the same frequency band without interference when they employ nearly identical orbital parameters.⁴⁷ To minimize intersystem interference, the systems' transmission characteristics must also remain at a relatively uniform level. Consequently, requiring homogeneous constellations represents another option for licensing Ku-band NGSO FSS systems.⁴⁸ We ask commenters to address whether we should adopt one or more unifying constellation designs that could accommodate seven NGSO FSS systems. The pending NGSO FSS applications include a wide range of constellation designs.

38. To facilitate competitive system designs under this option, we could adopt more than one homogeneous constellation design. We could then allocate an equivalent amount of the available spectrum to each design. Each NGSO FSS licensee would then be required to deploy its system within a defined envelope of orbital and transmission parameters comprising an identified constellation design, and to share its spectrum assignment with systems of like design. For example, if we determine that two homogeneous constellation designs can accommodate all proposals, then under this option, we would subdivide the NGSO FSS spectrum sub-bands into two equal segments. Each licensee would select between the two designs, implement its system in accordance with that constellation design's specifications, and share the spectrum designated for that design with the other NGSO FSS systems that also selected that design.

39. A variation on this option is to mandate only one homogenous constellation design, in one portion of the available NGSO FSS spectrum, and to allow NGSO FSS licensees who chose not to use that design to share the remaining portion of the NGSO FSS spectrum through another of the spectrum sharing options proposed in this *Notice*.

40. We seek proposals for specific constellation designs that we might adopt. Comments should address both the benefits and disadvantages of a homogeneous constellation design approach, especially with regard to a specific constellation design. We request that comments recommend values for a complete set of orbital parameters⁴⁹ and corresponding limits on a system's transmission characteristics that would ensure homogeneity of NGSO FSS systems. In addition, proponents of a specific design should demonstrate how the design serves the public interest. Likewise, opponents of a specific design should specifically address particular orbital parameters that are troublesome, discuss how a specific parameter or its value could be modified to mitigate those concerns, and propose modifications to the proposal. We also ask for comment on whether a particular design can support international operations, given that constellation parameters of NGSO FSS systems that are not serving the United States may not be compatible with a design we adopt.

41. Virtual Geosatellite, LLC (Virtual Geo) proposes a constellation design using highly elliptical NGSO satellite orbits.⁵⁰ Because this orbit is designed to emulate characteristics of

⁴⁷ See ITU-R S.1431.

⁴⁸ A homogeneous constellation standard is defined by a set of orbital parameters and transmission characteristics.

⁴⁹ Orbital parameters are typically comprised of: Epoch, Orbital Inclination, Right Ascension of Ascending Node (RAAN), Argument of Perigee, Eccentricity, Mean Motion, and Mean Anomaly.

⁵⁰ Virtual Geosatellite LLC Notifications of *Ex Parte* Presentations in ET Docket No. 98-206, November 21, 2000, November 28, 2000, December 15, 2000, and February 16, 2001.

conventional geostationary orbits during the specific operational phase of its orbit, the applicant describes it as a "virtual" geostationary system. Virtual Geo asserts that if the Commission were to adopt its proposed constellation design, that a much larger number of satellite systems could be accommodated than if another design were adopted.

42. The Virtual Geo proposal seeks to take advantage of the fact that satellites in certain NGSO elliptical orbits spend a significant portion of their orbital time transiting the apogee of their orbit.⁵¹ By choosing particular orbital parameters, Virtual Geo proposes that satellites in its proposed constellation design can be made to orbit so that their transit at apogee seems to slow to a speed that nearly approximates the rotational velocity of the earth. As a consequence of the large portion of orbit time spent at high elevation angles, these satellites appear to remain in a chosen position over the earth's surface for a significant period of time during their orbital apogee. A further consequence is that these satellite orbits can be defined so as to maximize the time spent covering a preferred location on the earth. We request comment on the overall concept of the homogeneous constellation design proposed by Virtual Geo, and secondly, on the specific orbital parameters that it proposes.⁵² We also request comment on the impact Virtual Geo's patent would have on applicants who may desire to implement a system following the proposed parameters suggested for use by Virtual Geo.⁵³

43. In considering whether to adopt a homogeneous design approach proposed by Virtual Geo or any other applicant, one of the factors we will consider is the possibility of future entry. We ask for comment on which constellation design, if any, would most likely allow significant future use of this allocated spectrum. We seek comment on all aspects of Homogeneous Constellations, including variations or alternatives that commenters propose.

44. With respect to the NGSO FSS applications that are now pending, Virtual Geo has also proposed a band sharing plan.⁵⁴ Its proposed band plan would allocate slightly less than half of all NGSO FSS spectrum in each sub-band to its proposed homogeneous constellation design, leaving slightly less than half of the spectrum to be shared among NGSO FSS licensees that do not adopt that design. According to Virtual Geo, another advantage of its design is that because it does not have the same interference concerns vis-a-vis GSO systems as other system designs, it could occupy the less desirable portions of each of the six sub-bands. The remaining portion of each NGSO FSS spectrum sub-band would be reserved as a growth zone, for later assignment to the systems first able to successfully implement their initial assignments. We request comment on this band sharing plan and on how to determine which parts of the sub-bands may be more desirable.

B. Earth Station Licensing

45. The *First Report and Order* recognized that the network architecture of NGSO FSS systems contains two different types of earth stations: gateway earth stations and user terminal earth stations.⁵⁵

⁵¹ The apogee is the point in the orbit of a satellite that is most distant from the center of the earth.

⁵² See Virtual Geosatellite LLC Notification of *Ex Parte* Presentation in ET Docket No. 98-206, February 16, 2001, at p. 3 (Definition Of Virtual Geostationary Satellite Orbit).

⁵³ United States Patents, David Castiel et al., Inventors, Number 5,845,206 (dated December 1, 1998) and Number 5,957,409 (dated September 28, 1999).

⁵⁴ Virtual Geosatellite LLC Notifications of *Ex Parte* Presentations in ET Docket No. 98-206, January 22, 2001 and January 24, 2001.

⁵⁵ *First Report and Order*, FCC 00-418, at ¶¶ 23-31.

By adopting a functional definition of gateway earth station use in the *First Report and Order*, we restricted NGSO FSS earth station usage in frequency spectrum bands shared with terrestrial operations. Only gateway earth station use is permitted in the 10.7-11.7 GHz, 12.75-13.15 GHz, 13.2125-13.25 GHz, and 13.75-14.0 GHz bands. This restriction is intended to avoid ubiquitous deployment of NGSO FSS earth stations in shared bands, thereby allowing the continued use and growth of terrestrial operations in those bands.⁵⁶

46. We did not intend, however, to restrict ubiquitous deployment of NGSO FSS earth stations in bands not shared on a co-equal basis with terrestrial operations. In the United States, those bands are the 11.7-12.2 GHz and 12.2-12.7 GHz downlink bands, and the 14.0-14.5 GHz up-link band. There may not be similar bands available in other countries. The NGSO FSS systems proposed in the applications now pending before us predict ubiquitous deployment of user terminal earth stations in those bands. In the past we have allowed blanket licensing procedures to regulate ubiquitously deployed NGSO earth stations in other satellite services.⁵⁷ We recognize that blanket licensing may also be the most practical and efficient regulation in this service, and therefore propose to adopt blanket licensing of earth stations in the Ku-Band NGSO FSS, for operations in these specific frequency bands. We seek comment on a blanket licensing approach that will facilitate operation of multiple NGSO FSS systems. We also propose to require an annual report of the number of user terminal earth stations actually brought into service under this blanket licensing authority. This is a reporting requirement instituted with blanket licensing in other satellite services. We request comment on its applicability to the NGSO FSS in the Ku-band.

47. In the *First Report and Order*, we stated our belief that the use of higher performance earth station antennas would maximize inter-service sharing, but recognized the physical limitations on the amount of sidelobe suppression achievable in small earth station antennas.⁵⁸ Two antenna performance standards were addressed in the *First Report and Order*, while a third was deferred to this proceeding. First, the EPFD_{up} limits adopted in the *First Report and Order* ensure protection of GSO FSS satellites from NGSO FSS earth station transmissions.⁵⁹ Second, we expect that our *Further Notice of Proposed Rulemaking* in ET Docket No. 98-206 will result in an adequate sharing scenario between NGSO FSS user terminal earth stations and MVDDS operations.⁶⁰ But we deferred until this proceeding whether to specify an NGSO FSS user terminal antenna reference pattern to facilitate intra-service sharing.⁶¹

⁵⁶ *Id.* at ¶ 29.

⁵⁷ See *In re Application of U.S. LEO Services, Inc., Order and Authorization*, 11 FCC Rcd 20474 (1996) (allowing blanket licensing of earth stations in the Big LEO service); *Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use, Notice of Proposed Rulemaking*, 15 FCC Rcd 13430 (2000) (*18 GHz Report and Order*) (allowing blanket licensing of NGSO FSS earth stations in the Ka-Band).

⁵⁸ *First Report and Order*, FCC 00-418, at ¶ 240. Sidelobe suppression refers to limiting emissions in directions away from the intended directions.

⁵⁹ *Id.*

⁶⁰ *Id.*

⁶¹ *First Report and Order*, FCC 00-418, at ¶ 239. As we described it there, off-axis e.i.r.p. density limits on GSO FSS earth stations minimize the interference that one GSO FSS satellite can cause into adjacent GSO FSS (continued....)

48. We recognize that specifying an antenna reference pattern for NGSO FSS user terminal earth stations does have the potential to facilitate sharing among NGSO FSS systems, but we have little evidence at this time that imposing additional limitations on NGSO FSS user earth stations will significantly improve that sharing. At the same time, we are concerned that imposing an antenna reference pattern will increase the cost for NGSO FSS user terminals and create additional regulatory burdens. We therefore propose not to mandate a reference antenna pattern for NGSO FSS user earth stations and seek comment on this approach.⁶²

49. In the *First Report and Order*, we determined that FSS earth station off-axis equivalent isotropically radiated power (e.i.r.p.) density limits are not necessary for GSO FSS earth stations operating in the 12.75-13.25 GHz, 13.75-14.0 GHz and 14.0-14.5 GHz, but deferred consideration of whether such limits are needed for NGSO FSS earth stations.⁶³ We recognize that spectrum use efficiencies are associated with these restrictions, but we are concerned that such regulations threaten the commercial viability and implementation of NGSO FSS proposals before us. We therefore propose not to mandate NGSO FSS earth station off-axis e.i.r.p. density limit.⁶⁴ We seek comment on the benefit of adopting limits on NGSO FSS earth station off-axis e.i.r.p. density, especially in view of the NGSO FSS spectrum sharing proposals raised in this *Notice*.

C. Service Rules

50. In the *Ku-Band Sharing NPRM*, we requested comment on a number of NGSO FSS licensing and service rule issues.⁶⁵ Several parties addressed those issues in comments filed in that proceeding.⁶⁶ Because our *First Report and Order* focused on inter-service spectrum sharing, we reserved NGSO FSS rules for this proceeding. We now seek comment on the following licensing and service rule issues in light of the decisions made in the *First Report and Order*, and in light of the NGSO FSS spectrum sharing proposals presented in this *Notice*.

51. **Coverage requirement.** We often establish coverage area requirements for NGSO systems to serve the domestic public interest in the creation of a seamless global communications network.⁶⁷ We

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satellites by constraining the combined power and antenna gain transmitted in directions other than the wanted direction.

⁶² ITU-R Study Group 4 is conducting technical investigations into this issue. See ITU-R Question 2-1/4 (Characteristics of antennas at earth stations in the fixed-satellite service); ITU-R Question 203-1/4 (The impact of using small antennas on the efficient use of the geostationary-satellite orbit).

⁶³ *First Report and Order*, FCC 00-418, at ¶ 237.

⁶⁴ ITU-R Study Group 4 is also conducting technical investigations into this issue. See ITU-R Question 231/4 (Sharing between networks of the fixed-satellite service using non-geostationary satellites and other networks of the FSS); ITU-R Question 236/4 (Interference criteria and calculation methods for the FSS).

⁶⁵ *Ku-Band Sharing NPRM*, FCC 98-310, 14 FCC Rcd at 1174-1177.

⁶⁶ See, e.g., Comments of Skybridge L.L.C., Comments of the Boeing Company, and Comments of Virtual Geosatellite, LLC (all filed March 2, 1999).

⁶⁷ See *Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626/2483.5-2500MHz Frequency Bands*, Notice of Proposed Rulemaking, ET Docket No. 92-28, 7 FCC Rcd 6414 at ¶ 23 (1992) (*Big LEO NPRM*); *Report and Order*, ET Docket No. 92-28, 9 FCC Rcd (continued....)

propose to adopt, for the NGSO FSS, coverage requirements similar to those we apply to the "Big LEO" systems operating in the 1610-1626.5/2483.5-2500 MHz frequency bands and the NGSO FSS systems in the 17.7-20.2 GHz and 27.5-30.0 GHz frequency bands.⁶⁸ Specifically, we will require that NGSO FSS systems be capable of providing service on a continuous basis throughout the fifty states, Puerto Rico, and the U.S. Virgin Islands. We also seek comment on whether we should require NGSO FSS systems to be capable of serving locations as far north as 70 degrees latitude and as far south as 55 degrees latitude for at least 75% of every 24-hour period.⁶⁹ The reason for this requirement in the case of the "Big LEOs" was to ensure efficient global use of a limited resource. We seek comment on whether the same rationale applies here.

52. **Financial qualifications.** Historically, the Commission has fashioned financial requirements for satellite services on the basis of entry opportunities in the particular service being licensed.⁷⁰ In cases where we can accommodate all pending applications and future entry is possible, we have not looked to current financial ability as a prerequisite to a license grant. But in situations where potential applicants appear to have requirements that exceed the available spectrum or orbital resources, we have invoked a strict financial qualifications standard. This policy is designed to make efficient use of spectrum by preventing underfinanced applicants from depriving another fully capitalized applicant of the opportunity to provide service to the public. Since this *Notice* proceeds from the assumption that a spectrum sharing plan can be devised to accommodate all the pending applicants' proposed systems and future entry, we are not proposing a strict financial qualification standard for this service. If, however, the record developed in this proceeding indicates that the allocated spectrum cannot accommodate all applicants, we may impose a strict financial qualifications standard.

53. Should we determine the need to impose strict financial qualifications, we seek comment on what demonstration of financial qualifications would adequately ensure an applicant's ability to proceed. We propose that each NGSO FSS applicant be required to demonstrate internal assets or committed financing sufficient to cover construction, launch, and first-year operating costs of its entire system. We will also require the commitment of funds not previously committed for any other purpose, as suggested in comments on the *Ku-Band Sharing NPRM*.⁷¹ If strict financial qualifications are invoked, applicants for NGSO FSS licenses will be required to demonstrate that they have assets or committed financing for their NGSO FSS systems that is separate and apart from any funding necessary to construct and operate any other licensed satellite systems. We request comment on these proposals, and ask whether there are

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536 at ¶ 21 (1994) (*Big LEO Report and Order*). See also *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services, Third Report and Order*, CC Docket No. 92-297, 12 FCC Rcd 22310 at ¶ 34 (1997) (*28 GHz Third Report and Order*).

⁶⁸ See *Big LEO Report and Order*, 7 FCC Rcd 6414 at ¶ 24; 47 C.F.R. §25.143(b)(2)(ii-iii); see also *28 GHz Third Report and Order* at ¶ 34.

⁶⁹ We propose that NGSO FSS systems be capable of serving locations as far north as 70° North latitude and as far south as 55° South latitude for at least 75 percent of every 24-hour period in order to cover the majority of the world's population.

⁷⁰ See 47 C.F.R. §§ 25.140(c), 25.142(a)(4), and 25.143(b)(3).

⁷¹ See Comments of The Boeing Company, ET Docket No. 98-206, filed March 2, 1999, at p. 67.

alternative means of oversight we can employ to ensure that licensees will be able to timely commence service to the public.

54. System license and license terms. NGSO systems historically consist of constellations of technically identical satellites that may be launched and retired at different times. Consequently, existing NGSO satellites in other bands and services have been authorized under blanket licenses.⁷² Under this approach, licensees are issued a single blanket authorization for the construction, launch, and operation of a specified number of technically identical space stations that constitute the satellite network constellation. The authorization covers all construction and launches necessary to implement the complete constellation and to maintain it until the end of the license term, including any replacement satellites necessitated by launch or operational failure, or by retirement of satellites prior to the end of the license period. All replacement satellites, however, must be technically identical to those in service, including the same orbital parameters, and may not cause a net increase in the number of operating satellites. The license term runs from the date on which the first space station in the system begins transmitting and receiving radio signals, and is valid for ten years from that point in time. There is a filing window for system replacement applications prior to the expiration of the license that allows sufficient time for the Commission to act upon replacement system applications. We believe it is appropriate to continue using this model of licensing for the NGSO FSS. We propose to require that replacement applications be filed no earlier than three months prior to, and no later than one month after, the end of the eighth year of the existing system license. We request comment on this proposal.

55. Regulatory Classification. In our *DISCO I Order*, we determined that all fixed-satellite operators in the C-Band and Ku-band could elect to operate on a common carrier or non-common carrier basis.⁷³ We see no reason to treat NGSO FSS satellite operators in the Ku-band any differently. All of the proposed Ku-band NGSO FSS applicants propose to operate all services on a non-common carrier basis. Given the nature of the services proposed by the NGSO FSS applicants, we request comment on whether operators of NGSO FSS systems in the Ku-band should be treated as non-common carriers

56. Implementation milestones. As with all other satellite services, we propose that all NGSO FSS Ku-band licensees adhere to a strict timetable for system implementation. Milestones are intended to ensure that licensees are building their systems in a timely manner and that the spectrum resources are not being held by licensees unable or unwilling to proceed with their plans to the detriment of other operators who might benefit the public interest by implementing satellite systems. We propose implementation milestones that track the schedules recently imposed on other NGSO systems.⁷⁴ Specifically, we propose that NGSO FSS Ku-band licensees must enter into a non-contingent satellite manufacturing contract for the system within one year of authorization, complete critical design review⁷⁵ within two years of authorization, begin physical construction of all satellites in the system within two and a half years of authorization, and complete construction and launch of the first two satellites within three and a half years of grant. The entire system will have to be launched and operational within six years of authorization. As is consistent with our

⁷² See, e.g., *Big LEO Report and Order*, 7 FCC Rcd 6414 at ¶¶ 182-187.

⁷³ *Amendment to the Commission's Regulatory Policies Governing Domestic Fixed Satellites and Separate International Systems and DBSC Petition for Declaratory Rulemaking Regarding the Use of Transponders to Provide International DBS Service*, 11 FCC Rcd 2429, 2436 (1996) (*DISCO I Order*).

⁷⁴ See *The Establishment of Policies and Service Rules for the Mobile Satellite Service in the 2 GHz Band*, 15 FCC Rcd 16127 (2000) (*2 GHz Report and Order*) at ¶ 106.

⁷⁵ The critical design review is the stage in the space station implementation process at which the design and development phase ends, and the manufacturing phase begins.

practice in other services, we propose to require operators to submit certifications of milestone compliance, or filing disclosure of non-compliance, within 10 days following a milestone specified in the system authorization. Failure to file a timely certification of milestone compliance, or filing disclosure of non-compliance, would result in automatic cancellation of an operator's system authorization with no further action required on the Commission's part.⁷⁶ We request comment on these milestones proposals.

57. Another possible approach to milestones is to tie the applicants in some way to the ITU "Bringing Into Use" date.⁷⁷ For example, we could require applicants to demonstrate that they are on a launch manifest at a designated point some months or years before the ITU Bringing Into Use date. We note that enforcement of milestones has increasingly required a significant investment of limited Commission time and resources that may be better spent on other proceedings. We seek comment on this or other possible minimalist approaches to implementation milestones.⁷⁸

58. **Reporting requirements.** We propose to apply to the NGSO FSS a slight variation of the Part 25 rules governing reporting requirements for FSS systems.⁷⁹ FSS licensees are required to file an annual report with the Commission describing: the status of satellite construction and anticipated launch dates, including any major delays or problems encountered; and a detailed description of the use made of each satellite in orbit.⁸⁰ Any anticipated delays in these schedules should result in a request for an extension of time. We propose to apply these requirements to NGSO FSS systems. We do not, however, propose to apply a requirement to report unscheduled satellite outages.⁸¹ This outage reporting requirement was a means of spectrum management instituted to ensure that satellite spectrum resources were not warehoused in orbit. We believe that the satellite spectrum resource availability that has developed obviates the need for this reporting requirement. We therefore propose not to apply it to this new service, and expect to revisit the application of the rule to other fixed satellite services in a separate proceeding later this year. We request comment on all these NGOS FSS reporting requirements proposals.

59. **Demonstration of Compliance with Aggregate EPFD_{down} Limits.** In the *First Report and Order* we recognized the need to limit cumulative interference from multiple NGSO FSS systems into GSO networks.⁸² We adopted aggregate validation EPFD_{down} limits for NGSO FSS operations in the 10.7-11.7 GHz, 11.7-12.2 GHz, and 12.2-12.7 GHz bands to protect GSO networks.⁸³ At the same time, we recognized that there are many regulatory difficulties in verifying compliance with aggregate limits.⁸⁴ We therefore decided not to require a demonstration of NGSO FSS compliance with the aggregate limits.

⁷⁶ See 47 C.F.R. §§ 25.161, 25.163.

⁷⁷ See ITU RR Art. S11.44.

⁷⁸ We plan to undertake an investigation of milestones issues by the end of this year, in a separate, broader proceeding not limited to this NGSO FSS service.

⁷⁹ See generally *Streamlining the Commission's Rules and Regulations for Satellite Applications and Licensing Procedures, Report and Order*, 11 FCC Rcd 21581 (1996) (*Part 25 Streamlining Order*).

⁸⁰ See 47 C.F.R. § 25.210(l)(1) and (3).

⁸¹ 47 C.F.R. § 25.210(l)(2).

⁸² *First Report and Order*, FCC 00-418, at ¶ 107.

⁸³ See 47 C.F.R. § 25.208(h).

⁸⁴ *First Report and Order*, FCC 00-418, at ¶ 107.

We warned NGSO FSS applicants, however, that we will require them to demonstrate their ability to meet aggregate EPFD_{down} limits that may be set in the future, as set out in Section 25.208(h). This issue is currently being considered within the ITU, with the active participation of the United States.⁸⁵

60. The regulatory difficulties that prevented us from mandating verification of aggregate EPFD_{down} limits have not been resolved at this time. Specifically, a suitable methodology has yet to be developed that would allow the calculation of the aggregate EPFD_{down} produced by all NGSO FSS systems, including systems not serving the United States. Without such methodology we cannot establish procedures for NGSO FSS applicants to follow for demonstration of compliance with the aggregate EPFD_{down} limits. We therefore propose to further defer mandating the aggregate limits demonstration requirement until this methodology is established and seek comment on the deferral.⁸⁶

61. On the other hand, we have already adopted a requirement that single-entry EPFD_{down} validation limits be demonstrated.⁸⁷ The single-entry EPFD_{down} validation limits were derived from the aggregate validation EPFD_{down} limits, using the methodology contained in ITU-R Recommendations, with an assumed a conversion factor of 3.5 NGSO FSS systems.⁸⁸ We view this conversion factor as a helpful guideline, although we recognize that it does not necessarily correspond to the number of NGSO FSS systems that can be accommodated in the spectrum we have allocated to the service. We expect that a good deal of time will pass before more than three NGSO FSS systems are operating co-frequency in the 10.7-11.7 GHz and 11.7-12.2 GHz bands. This fact diminishes the urgency for adoption of aggregate EPFD_{down} limits.

62. We seek comment on all aspects of the aggregate EPFD_{down} issue. We ask commenters to focus on whether our assessment of the timing of this issue is accurate. Commenters asserting that we should require NGSO FSS applicants to demonstrate compliance with the aggregate limits at this time are asked to specify a procedure they propose that we employ to accomplish the task.

63. *International Coordination.* Our rules provide no protection from interference caused by radio stations authorized by other administrations until U.S.-licensed satellite systems have completed international coordination.⁸⁹ Even so, in the past we have permitted licensing, launch and operation of U.S.-licensed satellite system before international coordination is completed, subject of course to not causing harmful interference to systems of other administrations and to accepting interference from other

⁸⁵ See Submission of the United States of America to ITU-R Working Party 4A (Doc. 4A/112). This document is a preliminary draft of a new recommendation entitled "Methodologies for Calculating Aggregate EPFD_{down} Produced by Multiple Non-GSO FSS Systems into a GSO Network."

⁸⁶ We note that in accordance with Resolution 76 (WRC-2000) and Resolution 137 (WRC-2000), the work on this methodology is progressing at ITU-R. See Resolution 76 (WRC-2000) (Protection of GSO FSS and GSO BSS Networks from the Maximum Aggregate Equivalent Power Flux-Density Produced by Multiple NGSO FSS Systems in Frequency Bands where EPFD Limits Have Been Adopted); and Resolution 137 (WRC-2000) (Further studies on the sharing conditions between GSO FSS networks and non-GSO FSS systems and between non-GSO FSS systems). We expect to address the issue regarding NGSO FSS licensee demonstration of aggregate EPFD_{down} limits when the ITU has completed its work on this methodology.

⁸⁷ See 47 C.F.R. § 25.146(a).

⁸⁸ *First Report and Order*, FCC 00-418, at ¶ 106.

⁸⁹ 47 C.F.R. § 25.111.

countries' systems.⁹⁰ We find no reason to deviate from that policy in this case but we seek comment on application of the policy to NGSO FSS systems. We propose to follow the coordination procedure prescribed by the ITU to effect coordination with other administrations for the U.S.-licensed Ku-band NGSO FSS systems.⁹¹

64. According to the ITU Radio Regulations, Ku-band NGSO FSS networks are not entitled to claim protection from interfering GSO FSS but are subject to coordination with respect to other NGSO FSS networks.⁹² We are concerned about how the NGSO FSS spectrum sharing arrangement we adopt for our licensees will affect international coordination of NGSO FSS systems. We long have recognized the desirability of internationally compatible band plans and frequency assignments, particularly for global systems. In our Big LEO proceeding, for example, we observed that global satellite systems would be more likely to succeed if individual administrations adopted complementary licensing schemes.⁹³ More specifically, in our Ka-Band Service Rules Proceeding, we adopted a policy of pursuing international coordination for U.S.-licensed satellite systems consistent with our domestic frequency band plans, recognizing that substantial delay in the implementation of service can result if United States licensees do not conform their international plans, but pursue differing and irreconcilable assignments on a country-by-country basis.⁹⁴ Although we indicated that there would be exceptions to this general approach, we found that this general policy would ensure timely coordination and prompt provision of service.⁹⁵ We ask commenters to address specifically whether the general policy adopted in the Ka-Band proceeding is appropriate for application to NGSO FSS systems in the Ku-Band.

65. We further seek comment on the extent to which the proposed NGSO FSS spectrum sharing options could achieve compatibility with the spectrum planning and satellite system licensing processes in other countries. Most telecommunications administrations require a new entrant in their market to complete domestic and international coordination with other operating systems, just as the FCC requires coordination before license in the United States. We are concerned that the first U.S.-licensed systems allowed access to provide service in another country might exploit this situation to gain a competitive advantage by delaying coordination with subsequent entrants. We seek comment on whether our proposed prohibition on exclusive arrangements is sufficient to ensure that no U.S.-licensed systems is prevented from providing service in other countries due to an inability to coordinate in that geographic area with other NGSO FSS operators we license.

66. **Orbital Debris Mitigation.** Currently, the FCC addresses concerns regarding orbital debris and satellite systems on a case-by-case basis. Any such concerns are analyzed under the general "public

⁹⁰ See *Big LEO Report & Order*, 9 FCC Rcd at 6018 ¶ 211.

⁹¹ ITU RR Article S9.

⁹² See ITU RR S5.441 and S5.484A.

⁹³ See *Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500MHz Frequency Band*, Memorandum Opinion and Order, 11 FCC Rcd 12861 at ¶¶ 52-53 (1996).

⁹⁴ *Ka-band Third Report & Order*, 12 FCC Rcd at 22337 ¶¶ 67-68. The Federal Communications Commission is responsible for U.S.-licensed systems no matter where they provide service, as it is the notifying administration to the ITU for these systems, and is therefore responsible for any interference events that are created by their operations.

⁹⁵ *Id.* at 22337-38 ¶¶ 67-71.

interest, convenience, and necessity," standard in the Communications Act. In our *2 GHz Report and Order*,⁹⁶ we adopted a requirement that applicants for 2 GHz MSS authorizations disclose their orbital debris mitigation plans. We propose to apply that requirement to NGSO FSS applicants as well, and seek comment on its application to this service. We also intend to commence a separate rulemaking proceeding proposing to adopt filing requirements for all FCC-licensed satellite services, including orbital debris mitigation issues, including selection of safe flight profiles and operational configurations, as well as post-mission disposal practices.

67. We anticipate that any authorizations for Ku-Band FSS systems will be conditioned upon compliance with disclosure or other requirements adopted concerning orbital debris, and that any authority granted to launch satellites may be conditioned on disclosure of debris mitigation plans and Commission approval of those plans prior to launch.

68. *Sale of license.* To discourage speculators and to prevent unjust enrichment of those who do not implement their proposed systems, we also propose a rule that prohibits any Ku-band NGSO FSS licensee from selling a bare license for a profit. This provision is not intended to prevent the infusion of capital by either debt or equity financing. Nor is this provision intended to prevent creative approaches to spectrum sharing by applicants wishing to adopt methods to increase the amount of spectrum available to their systems. Nevertheless, any transaction will be monitored to ensure that it does not constitute an evasion of the anti-trafficking rule.⁹⁷ We request comment on this proposal.

V. CONCLUSION

69. In adopting this Notice of Proposed Rulemaking, we intend to allow expeditious deployment of NGSO FSS in the United States, by establishing a spectrum sharing plan and service rules so that services can soon be provided to consumers and by allowing market forces to play a role in the implementation of these systems. We believe it is in the public interest to provide opportunities for multiple systems to compete, providing more service choices and competitive prices in the marketplace. Our expectation is that NGSO FSS providers will provide a vigorous, additional source of broadband service for consumers, in competition with existing satellite and terrestrial services. This *Notice* puts forth several options for assigning shared NGSO FSS spectrum resources, including incentives for rapid implementation of service. We believe that our proposals in this Notice are sufficiently flexible to accommodate the NGSO FSS systems put forth by the pending applicants. Furthermore, depending upon satellite constellation design, additional systems may be accommodated. We seek comment on these and other possible sharing proposals. We also request comment upon means by which we can create incentives for NGSO FSS licensees to serve underdeveloped areas in the United States and abroad. Finally, we request any other suggestions commenters might put forth with respect sharing or service rules for this new NGSO FSS.

⁹⁶ 15 FCC Rcd at 16127.

⁹⁷ See *Big LEO Report and Order* at ¶ 203; 47 C.F.R. §25.143(h) (prohibits Big LEO licensees from selling a bare license for profit); *28 GHz Third Report and Order* at ¶ 75.

VI. PROCEDURAL INFORMATION

70. *Initial Regulatory Flexibility Analysis.* The analysis pursuant to the Regulatory Flexibility Act of 1980, 5 U.S.C. Section 603, is contained in Appendix C.

71. *Ex Parte Presentation.* This is a permit-but-disclose rule making proceeding. Ex parte presentations are permitted, provided they are disclosed as provided in Commission Rules. See generally 47 C.F.R. Sections 1.1202, 1.1203, and 1.1206(a).

72. *Authority.* This action is taken pursuant to Sections 4(i), 7(a), 303(c), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 157(a), 303(c), 303(f), 303(g), and 303(r).

73. *Comment.* Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419, interested parties may file comments on or before June 18, 2001, and reply comments on or before July 19, 2001. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by paper copies. See Electronic Filing of Documents in Rulemaking Proceedings, 63 Fed. Reg. 24,121 (1998).

74. Comments filed through the ECFS can be sent as an electronic file via the Internet to <<http://www.fcc.gov/e-file/ecfs.html>>. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form <your e-mail address>." A sample form and directions will be sent in reply.

75. Parties who choose to file by paper must file an original and four copies of each filing. All filings must be sent to the Commission's Secretary, Magalie Roman Salas, Office of the Secretary, Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Room TW-A325, Washington, D.C. 20554.

76. Parties who choose to file by paper should also submit their comments on diskette. These diskettes should be submitted to: Commission's Secretary, Magalie Roman Salas, Office of the Secretary, Federal Communications Commission, The Portals, 445 Twelfth Street, S.W., Room TW-A325, Washington, D.C. 20554. Such a submission should be on a 3.5 inch diskette formatted in an IBM compatible format using *Microsoft Word* for Windows or compatible software. The diskette should be accompanied by a cover letter and should be submitted in "read only" mode. The diskette should be clearly labeled with the commenter's name, IB Docket No. 01-96, type of pleading (comment or reply comment), date of submission, and the name of the electronic file on the diskette. The label should also include the following phrase "Disk Copy - Not an Original." Each diskette should contain only one party's pleading, preferably in a single electronic file. In addition, commenters must send diskette copies to the Commission's copy contractor, International Transcription Service, Inc., 1231 20th Street, N.W., Washington, D.C. 20037.

VII. ORDERING CLAUSES

77. IT IS ORDERED, that pursuant to Sections 4(i), 7(a), 303(c), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 157(a), 303(c), 303(f), 303(g), and 303(r), this Notice of Proposed Rulemaking is hereby ADOPTED.

78. IT IS FURTHER ORDERED that the Commission's Consumer Information Bureau, Reference Information Center, SHALL SEND a copy of this Notice of Proposed Rulemaking, including the Initial Regulatory Flexibility Analysis to the Chief Counsel for Advocacy of the Small Business Administration.

79. *Additional Information.* For further information concerning this rulemaking proceeding contact: J. Mark Young at (202) 418-0762, internet: myoung@fcc.gov, International Bureau, Federal Communications Commission, Washington, DC 20554.

FEDERAL COMMUNICATIONS COMMISSION



Magalie Roman Salas
Secretary

APPENDIX A

Table 1 summarizes the NGSO FSS downlink bands and incumbent operations in those bands.

Table 1: U. S. Operations in the NGSO FSS Downlink Bands (Systems operate on a primary basis, except as noted)			
Band	10.7-11.7 GHz	11.7-12.2 Hz	12.2-12.7 GHz
Incumbent Operations	FSS (space-to-Earth)		BSS
	International systems only; 10.7-10.95 GHz and 11.2-11.45 GHz are planned bands		
	POFS and LTTS STLs	LTTS TV pickup and TV non-broadcast pickup stations (secondary)	POFS (secondary to BSS)
NGSO FSS	NGSO FSS gateways	NGSO FSS links	

Table 2 summarizes the NGSO FSS uplink bands and incumbent operations in those bands.

Table 2: U. S. Incumbent Operations in the NGSO FSS Uplink Bands (Systems operate on a primary basis, except as noted)					
Band	12.75-13.25 GHz	13.8-14 GHz	14-14.2 GHz	14.2-14.4 GHz	14.4-14.5 GHz
Incumbent Operations	Non-Govt. FSS uplinks				
	International systems only and is a planned band	Special FSS spectrum sharing requirements			
	POFS	Govt. radiolocation	Govt. and non-Govt. radionavigation (secondary to FSS)	LTTS TV pickup and TV non-broadcast pickup stations (secondary)	Govt. fixed and mobile (secondary)
	TV BAS; LTTS may use only 13.2-13.4 GHz	Non-Govt. radiolocation (secondary)	Non-Govt. land mobile-satellite uplinks (secondary)		
	NASA's Goldstone deep space receive site	Space research service and standard frequency and time signal-satellite service (secondary, except for some GSO space research space stations)			Radio astronomy observations may be made in 14.47-14.5 GHz band
NGSO FSS	NGSO FSS gateways		NGSO FSS links		NGSO FSS gateways

APPENDIX B: PROPOSED RULES

For the reasons set forth in the preamble, part 25 of title 47 of the Code of Federal Regulations is proposed to be amended as follows:

PART 25-SATELLITE COMMUNICATIONS

The authority citation for Part 25 continues to read as follows:

AUTHORITY: 47 U.S.C. 701-744. Interprets or applies Sections 4, 301, 302, 303; 307, 309 and 332 of the Communications Act, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 307, 309 and 332, unless otherwise noted.

1. Section 25.115 is amended by adding a new paragraph (f) to read as follows:

§ 25.115 Application for earth station authorizations.

* * * * *

(f) User transceivers in the non-geostationary satellite orbit fixed-satellite service (NGSO FSS) service in the 11.7-12.2 GHz, 12.2-12.7 GHz and 14.0-14.5 GHz bands need not be individually licensed. Service vendors may file blanket applications for transceiver units using FCC Form 312, Main Form and Schedule B, and shall specify the number of terminals to be covered by the blanket license. Each application for a blanket license under this section shall include the information described in §25.146.

2. Section 25.146 is amended by adding the following:

§ 25.146 Licensing and operating authorization provisions for the non-geostationary satellite orbit fixed-satellite service (NGSO FSS) in the bands 10.7 GHz to 14.5 GHz.

(g) **System License:** Applicants authorized to construct and launch a system of technically identical non-geostationary satellite orbit fixed satellite service satellites will be awarded a single "blanket" license covering a specified number of space stations to operate in a specified number of orbital planes.

(h) In addition to providing the information specified in §25.114 above, each NGSO FSS applicant shall provide the following:

- (1) A demonstration that the proposed system is capable of providing fixed-satellite services on a continuous basis throughout the fifty states, Puerto Rico and the U.S. Virgin Islands, U.S.; and
- (2) A demonstration that the proposed system be capable of providing fixed-satellite services to all locations as far north as 70 deg. latitude and as far south as 55 deg. latitude for at least 75% of every 24-hour period; and
- (3) Sufficient information on the NGSO FSS system characteristics to properly model the system in computer sharing simulations, including, at a minimum, NGSO hand-over and satellite switching strategies, NGSO satellite beam patterns, NGSO satellite antenna

patterns and NGSO earth station antenna patterns. In particular, each NGSO FSS applicant must explain the switching protocols it uses to avoid transmitting while passing through the geostationary satellite orbit arc, or provide an explanation as to how the power-flux density limits in Section 25.208 are met without using geostationary satellite orbit arc avoidance. In addition, each NGSO FSS applicant must provide the orbital parameters contained in Section A.3 of Annex 1 to Resolution 46. Further, each NGSO FSS applicant must provide a sufficient technical showing to demonstrate that the proposed non-geostationary satellite orbit system meets the power-flux density limits contained in Section 25.208, as applicable. And

- (4) A description of the design and operational strategies that it will use, if any, to mitigate orbital debris. Each applicant must submit a casualty risk assessment if planned post-mission disposal involves atmospheric re-entry of the spacecraft.
- (i) Considerations involving transfer or assignment applications.
- (1) "Trafficking" in bare licenses issued pursuant to paragraph (g) of this section is prohibited.
 - (2) The Commission will review a proposed transaction to determine if the circumstances indicate trafficking in licenses whenever applications (except those involving *pro forma* assignment or transfer of control) for consent to assignment of a license, or for transfer of control of a licensee, involve facilities licensed pursuant to paragraph (g) of this section. At its discretion, the Commission may require the submission of an affirmative, factual showing (supported by affidavits of a person or persons with personal knowledge thereof) to demonstrate that no trafficking has occurred.
- (j) Prohibition of certain agreements. No license shall be granted to any applicant for a NGSO system in the fixed-satellite service operating in the 10.7-12.7 GHz, 12.75-13.25 GHz and 13.75-14.5 GHz frequency bands if that applicant, or any persons or companies controlling or controlled by the applicant, shall acquire or enjoy any right, for the purpose of handling traffic to or from the United States, its territories or possession, to construct or operate space segment or earth stations, or to interchange traffic, which is denied to any other United States company by reason of any concession, contract, understanding, or working arrangement to which the Licensee or any persons or companies controlling or controlled by the Licensee are parties.
- (k) Implementation Milestone Schedule. Each NGSO FSS licensee in the 10.7-12.7 GHz, 12.75-13.25 GHz and 13.75-14.5 GHz frequency bands will be required to enter into a non-contingent satellite manufacturing contract for the system within one year of authorization, to complete critical design review within two years of authorization, to begin physical construction of all satellites in the system within two and a half years of authorization, to complete construction and launch of the first two satellites within three and a half years of grant, and to launch and operate its entire authorized system within six years of authorization.
- (l) Reporting Requirements. All NGSO FSS licensees in the 10.7-12.7 GHz, 12.75-13.25 GHz and 13.75-14.5 GHz frequency bands shall, on June 30 of each year, file a report with the International Bureau and the Commission's Laurel, Maryland field office containing the following information:
- (1) Status of space station construction and anticipated launch date, including any major problems or delay encountered;
 - (2) Identification of any space station(s) not available for service or otherwise not performing to specifications, the cause(s) of these difficulties, and the date any space station was taken out of service or the malfunction identified.

(m) **Financial Requirements.** Each NGSO FSS applicant must demonstrate, on the basis of the documentation contained in its application, that it is financially qualified to meet the estimated costs of the construction and launch of all proposed space stations in its system and the estimated operating expenses for one year after the launch of the initial system. Financial qualifications must be demonstrated in the form specified in § 25.140(c) and (d). In addition, applicants relying on current assets or operating income must submit evidence that those assets are separate and apart from any funding necessary to construct or operate any other licensed satellite system. Failure to make such a showing will result in the dismissal of the application.

(n) **Replacement of Space Stations within the System License Term.** Licensees of NGSO FSS systems in the 10.7-12.7 GHz, 12.75-13.25 GHz and 13.75-14.5 GHz frequency bands authorized through a blanket license pursuant to paragraph (g) of this section need not file separate applications to launch and operate technically identical replacement satellites within the term of the system authorization. However, the licensee shall certify to the Commission, at least thirty days prior to launch of such replacement(s) that:

- (1) The licensee intends to launch a space station into the previously-authorized orbit that is technically identical to those authorized in its system authorization and
- (2) Launch of this space station will not cause the licensee to exceed the total number of operating space stations authorized by the Commission.

(o) **In-Orbit Spares.** Licensees need not file separate applications to operate technically identical in-orbit spares authorized as part of the blanket license pursuant to paragraph (g) of this section. However, the licensee shall certify to the Commission, within 10 days of bringing the in-orbit spare into operation, that operation of this space station did not cause the licensee to exceed the total number of operating space stations authorized by the Commission.

(p) **Earth Station Reporting.** Licensees shall submit to the Commission a yearly report indicating the number of earth stations actually brought into service under its blanket licensing authority. The annual report is due to the Commission no later than the first day of April of each year and shall indicate the deployment figures for the preceding calendar year.

**APPENDIX C: INITIAL REGULATORY FLEXIBILITY CERTIFICATION and
INITIAL PAPERWORK REDUCTION ACT OF 1995 ANALYSIS**

INITIAL REGULATORY FLEXIBILITY CERTIFICATION

The Regulatory Flexibility Act (RFA),¹ requires that a regulatory flexibility analysis be prepared for notice and comment rulemaking proceedings unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities."² The RFA generally defines "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."³ In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.⁴ A small business concern is one which: (a) is independently owned and operated; (b) is not dominant in its field of operation; and (c) satisfies any additional criteria established by the Small Business Administration (SBA).⁵

This Notice of Proposed Rulemaking (*Notice*) seeks comment on various proposals for creating a spectrum assignment approach that would accommodate all proposed non-geostationary satellite orbit fixed satellite service (NGSO FSS) systems and provide service to consumers as quickly as possible. This *Notice* also seeks comment on proposals for service rules to apply to NGSO FSS systems.⁶ These actions are necessary for the Commission to evaluate these proposals and seek comment from the public on any other alternatives. The objective of this proceeding is to assign the NGSO FSS spectrum in an efficient manner and create rules to ensure systems implement their proposals in a manner that serves the public interest. We believe that adoption of the proposed rules will reduce regulatory burdens and, with minimal disruption to existing FCC permittees and licensees, result in the continued development of NGSO FSS and other satellite services to the public. If commenters believe that the proposed rules discussed in the *Notice* require additional RFA analysis, they should include a discussion of this in their comments.

The Commission has not developed a definition of small entities applicable to geostationary or non-geostationary satellite orbit fixed-satellite or mobile satellite service operators. Therefore, the applicable definition of small entity is the definition under the SBA rules applicable to Communications Services "Not Elsewhere Classified." This definition provides that a small entity is one with \$11.0 million or less in annual receipts.⁷ This Census Bureau category is very broad, and commercial satellite services constitute only a subset of the total number of entities included in the category.

¹ The RFA, 5 U.S.C. § 601 *et. seq.*, has been amended by the Contract With America Advancement Act of 1996, Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

² 5 U.S.C. § 605(b).

³ *Id.* at § 601(6).

⁴ *Id.* at § 601(3) (incorporating by reference the definition of "small business concern" in Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register."

⁵ Small Business Act, 15 U.S.C. § 632.

⁶ See paragraphs 50-69, *supra*.

⁷ 13 C.F.R. § 121.201, North American Industry Classification System (NAICS) Code 51334.

The rules proposed in this *Notice* apply only to entities providing NGSO FSS. Small businesses will not have the financial ability to become NGSO FSS system operators because of the high implementation costs associated with satellite systems and services. Since there is limited spectrum and orbital resources available for assignment, we estimate that only seven applicant entities, whose applications are pending, will be authorized by the Commission to provide these services.⁸ None of the seven applicants is a small business because each has revenues in excess of \$11 million annually or has parent companies or investors that have revenues in excess of \$11 million annually.

We therefore certify that the rules proposed in this *Notice* will not apply to any small entities. The Commission's Office of Public Affairs, Reference Operations Division, will send a copy of this *Notice*, including this certification, to the Chief Counsel for Advocacy of the Small Business Administration. A copy will also be published in the Federal Register.

INITIAL PAPERWORK REDUCTION ACT OF 1995 ANALYSIS

1. This Notice of Proposed Rulemaking contains either a proposed or a modified information collection. As part of our continuing effort to reduce paperwork burdens, we invite the general public and the Office of Management and Budget (OMB) to comment on the information collections contained in this Notice, as required by the Paperwork Reduction Act of 1995, Pub. L. No. 104-13. Public and agency comments are due on or before June 18, 2001. Comments should address: (a) whether the proposed collection of information is necessary for the proper performance of the functions of the Commission, including whether the information shall have practical utility; (b) the accuracy of the Commission's burden estimates; (c) ways to enhance the quality, utility, and clarity of the information collected; and (d) ways to minimize the burden of the collection of information on the respondents, including the use of automated collection techniques or other forms of information technology.

⁸ See ¶ 9, *supra*.

APPENDIX D: NGSO FSS SYSTEM APPLICATIONS

The following applications, and amendments to pending applications, were filed in response to a Public Notice, Report No. SPB-141 (released November 2, 1998) (*Ku-Band Cut-off Notice*), which established the cut-off date for filing non-geostationary satellite orbit fixed satellite service system applications in the 12.75-13.25 GHz, 13.75-14.5 GHz, 17.3-17.8 GHz and 10.2-12.7 GHz frequency bands. The cut-off date was established after SkyBridge L.L.C. submitted an application for authority to launch and operate a global network of NGSO satellites in these frequency bands.

In addition, as noted in the *Ku-Band Cut-Off Notice*, an application was filed in response to prior Bureau cut-off notices involving frequency bands different than those identified in the *Ku-band Cut-Off Notice*. Denali Telecom, LLC filed an application in response to the cut-off for applications above 40 GHz; the portion of its proposed system involving those frequency bands will be considered in the 40 GHz proceeding. Only those portions of the Denali applications involving Ku-Band frequencies will be considered in this proceeding and the license decisions that follow.

Boeing**File No.: SAT-LOA-19990108-00006**

Boeing has filed an application for authority to launch and operate a global constellation of NGSO FSS satellites. The proposed Boeing system consists of a twenty-satellite constellation operating at a medium earth orbit of 20,182 kilometers. The constellation consists of four orbital planes with five satellites per plane, inclined 57 degrees relative to the equator. Boeing request authority to operate its NGSO FSS system within the 12.75-13.25 GHz and 13.75-14.5 GHz bands for uplinks and within the 10.7-12.7 GHz band for downlinks. Specifically, Boeing proposes to use 326 MHz of service uplink spectrum and 1000 MHz of service downlink spectrum. Boeing also requests 600 MHz of spectrum for feeder uplinks and 1000 MHz for feeder downlinks. Boeing proposes to provide "bandwidth on demand" communication and data services. In addition, Boeing requests a waiver of Section 2.106 of the Commission's Rules in order to provide, on a secondary, non-interference basis, ancillary two-way data transmission services to user terminals affixed to mobile platforms.

Denali**File Nos. 160-SAT-P/LA-97/13
SAT-AMEND-19990108-00001**

Denali filed an application in response to the Commission's cut-off for additional space station applications and letters of intent in the 36-51.4 GHz Frequency Band. (See Public Notice No. SPB-89 (rel. July 22, 1997)). Denali requests authority to launch and operate thirteen satellites in highly elliptical orbit to provide FSS and MSS for domestic, international and foreign communications. In its initial application, Denali requested, among other things, 200 MHz for downlinks in the band 11.7-12.2 GHz in North America and 12.5-12.7 GHz in Europe and Asia. In response to the Commission's *Ku-Band Cut-Off Notice*, however, Denali amended its application to change some of its spectrum requirements. Specifically, Denali now requests 1000 MHz of spectrum in the 10.7-12.7 GHz band (preferably the band 11.7-12.7 GHz) for downlinks and 750 MHz for uplinks in the 13.75-14.5 GHz band.

Hughes**File No.: SAT-LOA-19990108-00002**

Hughes has filed an application for authority to launch and operate a global Ku-band broadband satellite system called HughesLINK (H-LINK). The proposed system consists of twenty-two NGSO satellites, operating in medium-earth orbits at an altitude of 15,000 kilometers. Eight satellites are in an equatorial-plane and seven are in each of two planes inclined at 45 degrees. The proposed H-LINK system requests to operate in one gigahertz of spectrum within the 10.7-12.7 GHz band in Region 2 and the 10.7-12.75 GHz band in Regions 1 and 3 for downlinks and one gigahertz within the 12.75-13.25 GHz, 13.75-14.5, and 17.3-17.8 GHz (Regions 1 and 3 only) bands for uplinks. Inter-satellite links are proposed in optical

frequency bands. H-LINK proposes to offer a wide variety of two-way, broadband services at data rates from 1.54 Mbps up to 155 Mbps, and to offer backbone infrastructure and a virtual private network.

Hughes**File No.: SAT-LOA-19990108-00003**

Hughes has also filed an application for authority to launch and operate a global Ku-band broadband satellite system called HughesNET (H-Net). The proposed system consists of a seventy NGSO satellite constellation operating at an altitude of 1490 kilometers. The constellation consists of ten planes, with seven satellites each, inclined at 54.5 degrees. H-Net proposes to operate in one gigahertz of spectrum within the 10.7-12.7 GHz band in Region 2 and the 10.70-12.75 GHz band in Regions 1 & 3 for downlinks and one gigahertz within the 12.75-13.25 GHz, 13.75-14.5, and 17.3-17.8 GHz bands (Regions 1 & 3 only) for uplinks. Optical inter-satellite link terminals are proposed for inter-operation with other satellites in the H-Net constellation. H-Net proposes to offer Internet access and support to both packet-switched and circuit-switched operation.

SkyBridge**File Nos.: SAT-AMD-1998-0630-00056
SAT-AMD-19990108-00004**

SkyBridge has filed an application, and amendments to it, for authority to launch and operate a global network of NGSO satellites. (See Public Notice, Report No. SPB-98, August 28, 1997 (accepting for filing the SkyBridge application, File No. 48-SAT-P/LA-97, as amended by the 1997 Amendment, File No. 89-SAT-AMEND-97); Public Notice, Report No. SPB-133, July 20, 1998 (accepting for filing the 1998 Amendment, File No. 130-SAT-AMEND-98); Public Notice, Report No. SAT-00013, March 23, 1999 (accepting for filing the 1999 Amendment, File No. SAT-AMD-19990108-00004)). SkyBridge requested authority to launch and operate a global network of non-geostationary orbit satellites providing a wide range of data, voice and video broadband services. Its proposed network consists of a constellation of 80 operational satellites, or 20 orbital planes with four equally spaced satellites per plane. SkyBridge requests at least 1.65 GHz of uplink spectrum (earth-to-space transmissions) within the 12.75-13.25 GHz, 13.75-14.5 GHz and 17.3-17.8 GHz frequency bands. SkyBridge also requests at least 2 GHz of contiguous downlink spectrum (space-to-earth transmissions) between 10.7 and 12.7 GHz. For its tracking, telemetry and control operations, SkyBridge requests 5 MHz of uplink spectrum in the same uplink bands requested for its service links (the 12.75-13.25 GHz, 13.75-14.5 GHz and 17.3-17.8 GHz frequency bands), and 30 MHz of downlink spectrum between 10.7 and 12.7 GHz.

Teledesic**File No.: SAT-LOA-19990108-0005**

Teledesic has filed an application for authority to construct, launch, and operate a global constellation of NGSO FSS satellites. Teledesic's proposed system, to be known as the Ku-Band Supplement (KuBS) system, will be comprised of thirty satellites, in six orbital planes with five satellites operating at an altitude of approximately 10,320 kilometers. Teledesic requests to operate its KuBS satellites in the 12.75-13.25 GHz, 13.75-14.5 GHz, and 17.3-17.8 GHz bands for uplinks and the 10.7-12.7 GHz bands for downlinks. Teledesic also proposes to operate a separate backup TT&C in standard C-band TT&C frequencies. Teledesic proposes to operate the KuBS constellation primarily as a high-bandwidth supplement to its Teledesic Network system authorized in the Ka-band (20/30GHz). Teledesic proposes to provide FSS on a primary basis but requests authority to provide MSS on an ancillary, non-interference basis.

Virgo**File No.: SAT-LOA-19990108-00007**

Virgo has filed an application for authority to launch and operate a global constellation of non-geostationary satellites operating in the FSS. The proposed system, VIRGO, consists of fifteen NGSO satellites operating in highly elliptical orbits operating at an altitude of 27,300 kilometers at apogee. Virgo proposes to operate with user uplinks in 14.0-14.5 GHz band and user downlinks in the 11.2-12.7 GHz band. Gateway links are proposed in the 12.75-13.25 GHz, 13.8-14.0 GHz, 17.3-17.8 GHz, and 5.925-6.725 GHz bands for uplinks

and the 10.7-11.2 GHz and 3.7-4.2 GHz bands for downlinks. Inter-satellite links are proposed in optical frequency bands. Virgo proposes to provide high speed Internet access and direct-to-home data and video services to small user terminals in most areas of the world.